NRM
MISC

0.93
(Italy)

AIMS AND PROBLEMS of ITALIAN FORESTRY

by Aldo Pavari

Translated from Italian

by M.B.Dickerman

DIVISION OF FOREST ECONOMICS

NORTHERN ROCKY MOUNTAIN

FOREST AND RANGE EXPERIMENT STATION

MISSOULA MONTANA

December 1947

Property of
National FS Library
USDA Forest Service
240 W Prospect Rd
Fort Collins CO 80526

Aims and Problems of Italian Forestry 1/

By: Aldo Pavari 2/

Translated from Italian by

M. B. Dickerman 3/

1/ A paper presented at the Italo-American Congress on Agriculture, Florence, Italy, January 1946.

2/ Director of the Royal Experiment Station of Silviculture, Florence, Italy.

3/ Chief, Division of Forest Economics, Northern Rocky Mountain Forest & Range Experiment Station, U.S. Department of Agriculture, Forest Service, Missoula, Montana; formerly Chief, Forestry Section, Allied Commission Italy.

Acknowledgment is gratefully made of assistance by Augusto Alfani, Technical Assistant, Forestry Section, UNRRA Italy Mission.

AIMS AND PROBLEMS OF ITALIAN FORESTRY

By Aldo Pavari

Forestry problems, differing from those of agriculture, are based on conditions which are much less subject to change; for example, the slight variations in growth, long growing cycles, and above all the greater dependence on environmental factors.

For the most part, forestry problems described and discussed for decades still exist and have yet to receive serious consideration, not to mention a solution. It may be helpful, however, to review these problems again, especially since the present-day crisis has greatly aggravated them. In fact, during the long years of war, the overcutting of timber greatly impoverished our already scanty forest patrimony. An alarming number of thefts and uncontrolled cuttings continue the depletion process. Nor is this all, the scourge of incendiary fires is spreading and the vandalism of grazing - an infraction of all regulations - is damaging mature forests and destroying natural reproduction and plantations in which much money and labor have been invested.

Therefore, if what I say makes no pretense of being new, it will show the imperative need for analyzing age-old problems once again and of indicating how they can and should finally be approached within our reconstruction program. Even were I to limit myself exclusively to the technical plane, I would be confronted with the task of not wandering off into the abstract. The practical application of silviculture is dominated by complex factors which have basic economic, social and political implications. On these factors depend the aims of forestry and its technical direction.

For obvious reasons, I shall treat this vast theme very briefly and incompletely in two parts: (1) the principal technical problems of Italian forestry; (2) ways and means of solving them.

I. TECHNICAL PROBLEMS OF ITALIAN FORESTRY

For progress in forestry, as much for water as for the wood which our country seriously lacks, the principal problems are:

1. Increasing and improving the productivity of existing forests.

2. Afforesting barren lands unsuited for agriculture and brush-covered lands.

3. Increasing wood production in agricultural areas by tree growing.

1. Increasing and improving the productivity of existing forests.

According to data from the 1929 agricultural survey and later findings, the Italian forest area was estimated to be from 5,685,000 to 5,816,000 hectares. The forest map of 1938 provided some information which, although approximate, is less vague than that previously available. It subdivides the area according to forest types, to tree species and to kinds of forest management. This map indicates an additional area of 362,380 hectares but, as this additional figure consists of badly deteriorated woods and brush, we should reduce the effectively forested area to 5,600,000 hectares. This includes only high forests, coppices with standards, and simple coppices.

The area covered by high forests is 1,850,000 hectares, in chestnut 500,000 hectares, in coppices with standards 200,000 hectares, and in simple coppices 3,050,000 hectares. For the present let us merely observe that, although noticeably less than that of coppices, the area of high forests, the principal source of industrial lumber, is significant, totalling more than half of that of the coppices.

About 1,170,000 hectares of our high forests are conifers and 680,000 hectares hardwoods exclusive of chestnut. Almost all the conifer stands found in the Alps, more than a million hectares, are Norway spruce, European larch, silver fir and Scotch pine. A little more than 100,000 hectares are in central, southern and insular Italy. Of these about 30,000 hectares of black pine are in Calabria and Sicily, as are a few thousand hectares of silver fir, Italian stone pine and aleppo pine.

Among hardwoods, first comes European beech with about 250,000 hectares, deciduous oaks 240,000 hectares, then evergreen oaks, holly and corks with about 190,000 hectares. The area covered by other hardwoods is negligible.

The basis of our forest wealth is the softwood forests of the Alps. Therefore any program to increase and improve this wealth must give first place to the technical and economic problems of conserving and increasing them. Our greatest scholars have treated this problem during the last decade with understanding and ability, but in translating study into action little has been done. This is not the time for an analysis of the problems themselves but it may be permissible to inject some personal views expressed on various other occasions.

The method of managing the Alpine conifer forests (mostly Norway spruce and Scotch pine, if we exclude the pure larch and the black pine in the south) has been until recently by the selection system. In Europe this method first emerged from empiricism to

translate itself into an accepted method of forestry during the glorious Venetian Republic of the 16th century, and the tradition is preserved today in the Cadore (southern Tyrol, northeastern Italy) and in all the eastern Alps.

But the decreased productivity of many forests, the difficulty of getting natural regeneration in Norway spruce in competition with less desirable species such as beech and silver fir, the diminishing fertility of the soil, and other drawbacks (among them the necessity of covering a vast area with periodic cutting to obtain a very small yield) have led many foresters and even authorative masters to advise against continuing the use of this system. As a result, we see some Norway spruce forests devastated through excessive cuttings, others suffering because of over-extended cutting cycles or through the lack of thinnings, to say nothing of the destruction of new growth by grazing. It has also been stated that Norway spruce, tending toward the even-aged, is not adapted to the uneven-aged forest in view of its biological needs in the alpine climate, etc.

To these observations which already have been disproved I reply with a simple statement: Our ancestors' practice of the selection system through the centuries has handed down to us our beautiful Alpine forests and in these forests the Norway spruce still represents the dominant species (that is more than 70 percent if we exclude the pure larch and the pine stands which are not considered here).

It is further stated that the evolution of present-day forestry has always emphasized the many advantages of the selection system, especially in mountain forests and that Switzerland has chosen this system above others even repudiating those systems popularized by the German school which advocates the even-aged forest. In the last ten years German foresters have reintroduced the selection system to replace the even-aged forest of which they were once so proud and which proved unsuccessful.

In view of these reorientations in European forestry (French forestry has always used the selection system in its Alpine conifer forests) it seems strange that in Italy, which is in the very cradle of the system, it should be looked upon as outmoded and unadaptable. Naturally there are particular ecological conditions favorable to other systems, as for example in Pusteria and in the high valley of Isarco where clear cutting is used on small areas. There are also numerous cases of even-aged stands lacking satisfactory reproduction where other methods must be employed, such as group cutting, strip cutting, etc. But the criterion which should be followed, by and large, is that of returning abnormal stands to normal whenever possible by applying the selection system in group and individual tree cuttings. The essential aim is to preserve the uneven-aged character of our Alpine fir forests, not only for

silvicultural but also for hydrological reasons, because uneven-aged forests are superior to even-aged forests in maintaining the permeability of the soil - the principal factor which increases the circulation of soil moisture in comparison with losses by surface run-off. As for the question of the failure of Norway spruce to respond to the selection system and its natural tendency toward the even-aged forest, it must be recognized that there are some good examples of even-aged spruce forests. These represent the exception rather than the rule. The lack of natural reproduction in pure Norway spruce stands is due to the fact that through man's interference, natural mixed stands of silver fir, beech, larch and Scotch pine have been supplanted. For this reason they must be converted to their natural state, maintaining at the same time the associated species in proper proportions. Even larch, a species more tolerant than Norway spruce, cannot reproduce itself in pure stands without clear cutting, whereas in a mixed forest it reproduces easily even under beech and silver fir. In conclusion, let us be prudent before radically modifying, or worse, supplanting a system which has proved itself throughout the centuries. Let us rather think of perfecting it after the example of Switzerland.

It would be too lengthy here to set forth even in broad lines the manner of obtaining this improvement. Let us say that it can be realized by transforming a selection system from an extensive to an intensive system, by requiring a more frequent use of mature technicians and by better utilization.

And now we come to the conditions necessary for action, a subject which is of decisive importance since every technical analysis is worthless if it is not applied.

A tremendous task lies before us. For example, we can consider as normal an average annual increment in Alpine spruce of about 2.5 cubic meters per hectare. On extensive areas the increment is today much less because of the lack of growing stock. There naturally remains nothing to do but to adopt the policy of waiting and of slow replacement. Over large areas the increment is lower than the average because of poor silvicultural management. Perfecting it would permit a noticeable increase in the increment.

If we should succeed on little more than half of our spruce forests (600,000 hectares) in increasing the average annual increment a half of a cubic meter per hectare, we would increase the annual growth more than 300,000 cubic meters. This is a conservative estimate considering that in Switzerland in a few decades increments have gone from 2.5 - 3.0 cubic meters to 6 and 8 cubic meters per hectare in typically mountainous forests, at the same time augmenting the growing stock. But even without reference to this surprising figure, it is not too bold to strive for an increase of 500,000 cubic meters annually. This is equivalent to one third of the volume of coniferous industrial wood imported in 1935. At the same time we would

salvage the great mass of wood left from sales and improvement cuttings.

As for the non-Alpine coniferous forests, we have seen that the area covered is small. It includes the pine forests of the Sila, the fir forests of the Apennines, and the coastal pine forests which suffered so much during the war. We can only hope that the Allies will spare us further damage to this forest patrimony, so much the more precious and dear to us in that it is a modest one. Thus they can make less difficult the task of reconstruction.

We come now to the hardwood forests. Beech forests cover about 250,000 hectares, of which 55,000 are in northern Italy, about 35,000 in central Italy and about 160,000 in southern Italy. In the first, largely in the eastern part of the Alps, are included the magnificent beech forests of Ternova and the Julian Alps towards which at present we look with anxiety. In the Apennines, with few exceptions, the beech forests are in a mediocre, and in some cases poor condition, because of the lack of intelligent care and, what is worse, as a result of vandalism and unrestricted grazing. This is especially noticeable in the communal and collective properties of the central Apennines where the remaining beech stands are inaccessible and hence of little commercial value. Here one frequently witnesses the contrast between sterile, barren mountains and century-old productive beech forests.

The practices which should be followed to transform the Apennine beech forests to the shelter-wood system (procedures which should be followed with great caution, in view of the differences in climate from those of the Alps) will meet with insurmountable difficulties so long as care is not exercised in locating roads and in grazing sheep on reforesting areas.

But these are all problems which must be faced and solved in view of the importance of the results. Even in the south beech is capable of remarkable quantity and quality growth. In many Calabrian beech stands one finds a growing stock of 700 to 800 cubic meters per hectare; recent reports disclose average annual increases of 8 and sometimes even 10 cubic meters per hectare.

In the Apennine region, particularly in the southern part, in contrast to the Alpine region, progress will be rather slow. It is hoped that the state will take a hand in accelerating management progress and in acquiring, where possible, large tracts of beech forests.

A basic question is the conversion of the Apennine beech stands to conifers. This has been frequently advised by our leading scientists and in part already put into effect. It is one of the most effective means for increasing softwood production and for fully answering the requirements of good forestry so that silver fir may be brought back

to many natural habitats from which it disappeared. The conversion, however, should concern itself with deteriorated beech stands, exclusive of coppice which we shall consider later, rather than with stands which are in good condition, and which provide industrial wood.

The great value which beech has come to have for the plywood industry has clearly altered the terms of comparison between beech and silver fir, thus demonstrating once more the difficulty forestry has in following, within the length of its cutting cycle, the continual fluctuations in the value of wood. The partial conversion of beech stands to mixed beech-fir stands rather than to pure fir stands appears even more desirable from the cultural-biological viewpoint. However, I advocate the preservation of our best beech forests. To this we must dedicate all our energies to obtain growth of high quality. The application of thinnings always effective in beech may be a truly decisive factor.

After the beech forests, our principal broad-leaved timber types are the oaks: the deciduous species -- Durmast, pubescent, English, Turkey, Italian oaks, etc. and the evergreen species -- holly and cork oaks.

Recent statistics indicate an area of about 240,000 hectares in deciduous oaks, 110-120,000 hectares in holly oak and 70,000 hectares in cork oak. These are only approximate figures as they do not include the mixed forests and some classified as high forests are more correctly coppices with standards. However, the oaks involve a large total area, more than 400,000 hectares. They are located mostly in central, southern and insular Italy. High stands of broad-leaved oak are found in various places and under different conditions. We have the beautiful Turkey oak forest with tall, straight trunks located in Lazio, Molise and Basilicata, the vigorous pubescent oak forests in Umbria and Tuscany, the century-old holly oak forests covering some of the slopes of Sardinia, and the thick, cork oak stands of Gallura, but in general most oak forests are in poor condition. Uncontrolled and excessive cuttings, fire, grazing and especially the increasing demand for fuelwood and railroad ties, have all reduced, often entirely destroyed the growing stock, eliminated natural regeneration and aided soil deterioration.

The problem of the oak forests is largely one of meeting present and future needs for construction timber and fuelwood. Thinking only of the enormous demand for ties in reconstructing our railroads, it is difficult to see how we can preserve from total ruin our growing stock which is of such high economic value for both forestry and game. This problem mainly concerns the oak forests of central Italy with the exception of the Turkey oak stands well managed under the selection system, and of the pubescent oak forests, managed under the shelter-wood system. The latter being a tolerant species could be transformed gradually from high stands

to coppice with standards, thereby increasing growth and volume of much needed oak timber.

These oak forests are chiefly a part of the share-cropping farms; in addition to lumber, they supply acorns, pasture, branchwood for fuel and leaves for forage. As I pointed out in a 1934 discussion on the oak forests of Tuscany, coppice with standards is much more desirable than high stands. Coppice with standards produces more fuelwood and charcoal and protects the soil. High stands, on the other hand, yield more construction timber and acorns (although the acorns are small owing to the intense light necessary for acorn production) but they also tend to lessen soil fertility and implement erosion.

Coppice with standards would bring back soil fertility in stands which are now understocked. However, this conversion will fail, if sheep grazing is not controlled.

Our few thousand hectares of cork oak are very small in comparison with the thousands of hectares in Spain, Algeria, Tunisia and Morocco, but in poor regions like Sardinia, cork is important. The small quantity is offset to some extent, especially in Sardinia, by the high quality. Exportatiom of cork is significant in our trade balance. Countries not having cork have endeavored to substitute other products but so far have not been successful. Doubling the cork area appears to be highly desirable. Improvements in management practices should also help increase yields. Experimental work is needed.

The fruit chestnut is a special type - a connecting link between silviculture and horticulture. According to 1945 statistics, the chestnut type covers 477,000 hectares. It occurs in decreasing proportion from northern to southern Italy. Chestnuts grow rapidly and with the food shortage due to the war, the fruit is a much needed food resource, especially for our mountain people. However, information, competition and meetings have not yet succeeded in increasing the yield nor improving its quality. While a good chestnut grove will give 15-20 quintals per hectare of fruit every year, the average Italian crop is less than 7 quintals. The primary reasons for such low yields are: the excessive subdivision of properties and too many poor trees on favorable sites. That is why we should convert unproductive chestnut areas to other forest or agricultural uses and improve only those which would greatly increase the chestnut crop. The problem at the moment is complicated by the food shortage which makes it inadvisable to give up even the poorest food resource. At the same time the chestnut is threatened by Phytophtora cambivora and Endothia parasitica. These diseases make it difficult to suggest more intensive cultivation as pruning and grafting of new varieties because of the great risk involved. The Ministry of Agriculture and Forests, after recognizing the importance of the problem, has

designated the Royal Station of Vegetable Patology of Rome and the Royal Station of Silviculture in Florence to undertake research on methods of controlling these diseases and for suggesting other farm products as substitutes in case the chestnut trees are killed. We hope to stop the spreading of this new disaster and to save the chestnut forests which have great value in our mountain economy and for which Italy holds the first place in the world.

Coppice and coppices with standards - The area under coppice is about 3,000,000 hectares and represents 53 percent of the total forest area. Adding an area of about 200,000 hectares of coppice with standards gives a total of 56 percent under the coppice system. This has always been considered a weakness in Italian forestry. Coppice is chiefly a producer of fuelwood in comparison with high stands producing construction timber which our country needs greatly and has so little. Consequently, it has been suggested that the conversion of coppice to high stands be undertaken over large areas of at least one hundred thousand hectares. In a 1935 paper, I noted that such a conversion should only be done slowly and under special conditions as coppice must always remain prominent in our silviculture. Some of the reasons are:

a. Coppice is basic in providing charcoal for people on farms and villages.

b. The unfavorable location of mountain forests makes fuelwood and charcoal financially more attractive than growing timber.

c. Conversion would be very difficult in extensive areas of low fertility.

d. Coppice meets the requirements of an agrarian economy by supplying the wood needed for vineyards, citrus, tobacco and vegetables, as well as box material for packaging for export these products and cheese.

e. Coppice management needs much more hand work than high stands, thus, it provides many jobs for the large population.

f. The Mediterranean climate is favorable to coppice, thereby helping to increase the yield which often exceeds that of high stands. The average annual increment of high stands is not more than 1.5 cubic meters per hectare, while the average of coppice stands is about 3 cubic meters, some having a maximum of 12-15 and occasionally 20 cubic meters per hectare.

g. Coppice has a short rotation in comparison with high stands. This is financially expedient as the largest part of the Italian forests are in private ownership.

It is easy to understand the great importance of coppice woods and I do not regret that the area is more than half of the total. It

would be well to have half our forests in high stands if these were in efficient, productive condition, but they are not. To overcome our deficit in construction timber we must improve and use our high stands intelligently. One third of the 3,000,000 hectares of coppice forests are in very bad condition and improvement is necessary. This can be done only by following good technical rules including protection from grazing, increasing the rotation and substituting clear cutting for the selection system in beech coppice forests. Conversion of unproductive coppice into softwood high stands or into coppice with standards having some conifers is desirable. The conversion of coppice, mainly oak, into coppice with standards to increase the production of timber, acorns and forage, and to improve soil fertility is most important. Summing up, the conversion of coppice into other types of management should not be done without previously planning and selecting those areas where conditions are favorable. Ownership is an important adjunct to such planning.

2. Afforesting barren lands unsuited for agriculture and of lands with brush cover. It has been argued whether reforestation should be done primarily for hydrologic or for economic reasons. Such general discussions are useless as it depends upon the individual case. Selection of lands to be reforested, the species to be used and the kind of forests desired are closely related to the above. The hydrologic reason is foremost when we find mountain watersheds with landslides and erosion. Here we should choose the system which will give us the best and quickest results. Recent investigations, including some in Italy, have shown wide differences in the effect of forest types on retarding runoff. To facilitate our task we should delay artificial reforestation of bare soils which are not now eroding. By fencing to encourage natural regeneration, these areas will slowly reforest. For some time funds available for planting will be small so that it is advisable to use them upon the more urgent and more important tasks. We should not forget the 362,000 hectares of devastated forest land now almost entirely brush covered. It would be easier and quicker to reforest these than to reforest barren rocky land. The control of grazing is indispensable.

From the economic standpoint we should consider the desirability of meeting our own wood requirements. To do this we must choose lands where trees will grow rapidly and give high quality material. Such trees as poplar, black locust and alder are recommended. Where we find such conditions, planting meets not only public but also private needs. Introduction of exotic species has helped this new system of high-income silviculture not only in the plains and the hilly lands, but also in the mountains. For example, in 1924-25 in the Montimannu State Forest, the Experiment Station began reforesting the Rio Leni torrent which was dry most of the year, full of stones, and supported a few sprouts of oleander and thorny bushes along the banks. Australian locusts (Acacia pycnantha, mollissima melanoxylon) and eucalypti (Eucalyptus rostrata and globulus) were planted. In a few years a vigorous forest was established. Subsequently, the forest administration

reforested all the above mentioned banks within the State Forest, approximately 25 hectares. In 10 years these barren banks produced eucalyptus trees having an average height of 12-15 meters with some as tall as 20-25 meters. In 1941 one of the "sample plots" was clear cut, 1,052 trees yielding 392 cubic meters, or 1,100 trees per hectare gave 409 cubic meters. In 16 years the average annual increment per hectare was 25 cubic meters.

In Sardinia there are miles of stream banks and thousands of hectares in the same condition. It would have been possible to follow the above mentioned experiment on a large scale in place of expensive oak and pine planting on hilly slopes where the scrubby Mediterranean flora would have reforested naturally. Had this been done Sardinia might now have a growing stock of hundreds of thousands of cubic meters of timber for use in the mines. Attempts have been made to establish fruit orchards in the peat soils of northern Lombardy, but for the most part without success. Forestry is more suitable than agriculture. Black locust and pine are good species for this area, but imported species are even better. In northern Lombardy, American red oak grows more rapidly than English oak. At 40 years and with 500-800 plants per hectare, red oak yields 500-600 cubic meters. Managed under a coppice system with a 15-16 year rotation, the annual increment may be more than 9 cubic meters, twice that of the native oaks. Among softwood are the eastern white pine (Pinus strobus) and Japanese larch (Larix leptolepis Murr). Many other species are now under experimental observation. The above illustrate that with a short rotation of 30 to 40 years a good growing stock can be established. In the Apennine region many experimental Douglas-fir plots at 50 years give a yield equivalent to silver fir at 100 years. Experimental work is needed to develop new forms of intensive silviculture to shorten the rotation age and increase financial returns. We must have short rotations to encourage investments in forestry.

Genetics are basic to progress and there is much yet to be known. Every progressive forestry country is considering its source of seed and we should do likewise. It is desirable that we make a forest inventory to show where seeds of certain strains and qualities of the more outstanding species can be obtained.

3. Increasing wood production in agricultural areas. The high temperature and intense light of the Mediterranean climate make it possible for Italian agriculture to grow various trees with agricultural crops. This practice is found not only in central and southern Italy and in Sicily and Sardinia, but also in northern Italy where the climate is more moist and continental.

In the Po valley the broad, fertile and irrigated lands from the Piemonte to the Veneto are lined with poplar, willow, elm, sycamore, oak, ash, etc., the dry lands of Piemonte and Lombardia with mulberry trees, and the fertile flat lands of Emilia and Romagna, from Reggio Emilia to Modena, Bologna, Forli, Ferrara and Ravenna with elms supporting grapevines.

In both pure and mixed plantations of olive trees in the northern Apennines the cultivation of agricultural crops and trees is increasing. Vines are supported by such trees as maple, elm and ash. In the south, mixtures of olive, almond, carob trees and vineyards are common, especially on the stony and sloping lands along the Amalfi Coast and on the calcareous soils of Puglia and Sicily. In the intense light of these areas it is possible to have trees and crops growing together, one under the other. On the fertile lands of Campania are mixtures of olive, poplar, walnut, lemon and apple trees supporting vines and interplanted with wheat and vegetables. Similar mixtures are found in Calabria and Sicily.

The association of field crops with trees is an outstanding characteristic of advanced agriculture. Where there are no trees, agriculture is backward as in the wide alluvial areas of central and southern Italy, the flat lands of the Puglie, along the coast of the Ionic sea, on large Sicilian and Sardinian estates, and in the vicinity of Grosseto.

The fuelwood produced by these field trees in 1929 was more than 12 million cubic meters, which was much more than that produced by our forests. From 1933 to 1937 the production of fuelwood from forests averaged 10,622,000 cubic meters annually. On the irrigated lands of Lombardy the annual growth of fuelwood is 2.5 cubic meters per hectare of farmed land. In the low Veneto we obtain yearly 4 cubic meters and some times more than 6 from the pruning of willow stubs. This is certainly more than that of a good Turkey oak or of black locust coppice. Pure poplar stands covering only 19,000 hectares have an annual yield of nearly 2,000,000 quintals. In 1936 the paper industries needed 10,000,000 quintals and were supplied almost completely from the Po plains; hence the yield of poplar alone from field trees might be 5 to 6,000,000 quintals, or about 550,000 to 700,000 cubic meters.

Sicily has a productive land area of 2,433,045 hectares of which, including chestnut, 88,935 hectares are forested and 484,000 hectares are fruit orchards. In 1929, 6,000,000 quintals of fuelwood and almost 14,000 cubic meters of construction lumber were cut from fruit orchards and farm lands. This is about 2 cubic meters per hectare each year or about the average yearly increment of coppice.

Field trees were a major source of wood during World Wars I and II. Consequently, tree culture on farm lands should be increased and improved. We already have a good example in the Terralba (now called Arborea), a reclaimed area in Sardinia. After the first experimental period from 1925 to 1931 extensive shelterbelts were planted. These totalled 1,500,000 trees on 5,600 hectares and included plantings of eucalyptus, poplar and willow. These plantations in 1945 were of great importance to wheat farms. Moreover, the annual yield is now enough to meet farm requirements for wood and to provide pit-props

for Sardinian mines. The average annual yield is 2 cubic meters for each hectare of agricultural land.

Similar work was started on a larger scale by Opera Nazionale Combattenti in the Pontine Marshes. A plan was worked out for windbreaks on 40,000 hectares which required nearly 5 million trees. The work was started in 1937. By the end of 1943 one-third of the work was completed. Species planted included eucalyptus, locust, Monterey pine and Siberian elm.

Unfortunately this work which would have changed the appearance of the Pontine Marshes was damaged by the war; we do not know when it will be started again. Nevertheless, these illustrations show how we can have high yields in southern Italy as well as in the Po valley and that it is possible to use to great advantage the agricultural lands which are much more fertile than the forest lands.

This is a new and significant part of the national wood economy. Its success depends upon chosing species that grow fast and are suitable to the dry summers and mild winters of the Mediterranean climate. If this is done good results may be obtained in a short time instead of waiting for the slow growth on forest land.

II. WAYS AND MEANS OF SOLVING FORESTRY PROBLEMS

When we come to the application of technical knowledge we must take into consideration economics of forestry and national policies. My studies compel me to be cautious.

All the questions of Italian forestry and their relation to the physical, social and economic conditions and politics of the nation are one problem. Many aspects of this problem, historical and current, have been studied and discussed for 70 years. Now they are very evident. The basic forest policy was set forth in the law of 1923 and in the land improvement and reclamation act of 1933. The intent of these laws was to establish a policy for overcoming the evercurrent conflict between Italian agriculture and forestry on mountain lands.

We should not overlook the important work of the fascist government in carrying out the water control and soil erosion programs in mountain basins by reforesting and by protecting the forests. At the same time we should mention that since the establishment of the Milizia Forestale in 1927, the law of 1923 was disregarded and provincial forestry boards (Comitati provinciali forestalli) were suppressed. Every small and reasonable change in land use from forestry to agriculture was arbitrarily forbidden. Above all, the application of the most significant feature of the law, that forestry must not be considered alone but together with other uses of the soil, was neglected. Conserving, improving and extending forests must not be carried out without at the same time improving pastures and

mountain agriculture, This is the basic premise without which any plan would fail.

The climatic and physiographic factors, especially in most mountain areas, are so favorable that Italy could become a self-sustaining country so far as wood products are concerned. Prof. N. B. Brown recently stated that Italy might even become a lumber exporting country instead of being an importing one.

The great density of population is a factor which discourages wise soil use. It compels us to expand, wherever possible, farm land and pastures which supply our daily needs. Moreover, because of our poor soils, dry climate and inadequate communications this problem is accentuated.

The difficulty is of varying intensity due to the many climatic and physiographic differences found in our country from the Alps to Sicily. This explains why discussions about the relation of forestry to population reach no conclusion when they are considered from a general standpoint. They must be considered area by area.

There is a very delicate relation between pastures and woods. In the Alps the improvement of mountain pastures may be an efficient means for improving and expanding forests as the increased forage yield of pastures on good soils may encourage regeneration on the poor soils; thus each benefits the other. But this is not all, the temper and tradition of mountain people, their system of life, their type of agriculture, and the importance of a proper balance between pastures and forests must be recognized as fundamental in the land economy.

In the high lands of the Apennines, especially in the south, climatic and physiographic factors are seldom favorable for grazing. These areas are usually grazed by sheep and goats in migratory bands in contrast to the Alpine zones where they graze on the same area each year. Lacking moisture, the Apennine grasslands dry up in the summer. It is common then for the animals to enter the woods where they feed on young sprouts, leaves and some grass. For this reason, improvement of pasture lands would be a major factor in preventing grazing of forest areas, thereby preventing further destruction of the forest. However, climatic factors in the Apennines make it difficult to introduce many technical improvements commonly used in the Alps. It seems almost incredible that such a basic problem, covering wide areas and involving the control of soil erosion, has not been studied experimentally. Only such work can provide good rules for preventing further forest destruction. In many areas erosion has already reached the stony strata.

On low mountainous and hilly lands, pasture improvement work is less important in the relation between forests and agriculture. Naturally, this problem varies from region to region. For example,

the oak forests are typical and predominant in the hilly areas. These are one of the basic parts of the agricultural economy as they provide both fuel and forage. Even so, many oak woods are being converted to farm croplands, but the forest areas continue to be over-grazed and further deteriorated by excessive removal of the litter and acorns. Moreover, these woods, which should be used only by hogs, are grazed by both sheep and cattle. This occurs not only in regions having extensive grazing areas as in the Basilicata and in Calabria, but also in densely settled regions as the share-cropped farm-forestry lands of central Italy. On such farms in the Tuscany, Umbria and Marche regions it should be easy to set up a system for increasing forest and crop yields and for decreasing grazing.

Grazing of oak woods results in exhaustion of the forest as well as a decrease in forage for hogs. Entire areas have been denuded and now are almost deserts and steppes. The barren steppe region of Spain illustrates this. There, not so long ago, more than 72,000 square kilometers were covered with rich oak forests and extensively used for hog production.

The proper balance between forests and pastures is basic to successful forestry and animal husbandry. Foresters know that woods are beneficial and irreplaceable in Italy as in all the Mediterranean countries. As these woods are also useful for animal production, agricultural and animal husbandry men must cooperate in making and maintaining the proper balance. Success depends on developing local land attitudes. Such attitudes are exceedingly variable and what is needed even more than new laws is competent aggressive leadership.

Forestry and grazing problems have been solved one after the other under the most difficult conditions only by the continued patience and goodwill of sincere men. The largest state forest in the province Aigoual in France was established in an area of more than 13,000 hectares without opposition of local shepherds because two great forestry apostles, George Fabre and Charles Flahault, gave nearly 40 years of their lives to this cause. In Italy many thousand hectares between Mount Balbo and Verona were reforested by forest inspector Pellegrini, and similarly, the beautiful planting of the Sele watershed near Bagnoli Irpino is due to the efforts of Prof. Giuseppe di Tella.

I have pointed out these areas to show that mountain land problems need qualified men who enjoy their work. They must live in the same zone for a long time to become acquainted with all local factors and to acquire patience and persistence. Consequently, it is desirable to keep foresters in one forest region for many years, just the opposite of what has happened in the last 20 years.

What should be the functions of government in forest rehabilitation is another difficult subject. First, we must assume that the present

economic and social structure will continue. We know that the 1923 law permits action by the government, by institutions and by individuals. It is enough to recall the establishment of special agencies for the administration of forests and pastures including communal lands and the different means of encouraging the practice of forestry by private owners. Unfortunately, these parts of the law were violated. Progressive and unrelenting state centralization through the Milizia Forestale went on. Special agencies and the so-called local forest management agencies (Condotte forestale) were stopped just as they were getting under way. The National Mountain Secretary Board (Segretariato Nazionale per la Montagna) was suppressed although it was very helpful to communes. Every action of institutions, societies and individuals in forest improvement work was hindered instead of encouraged. Therefore, we do not know what might have been the result of our forestry law.

At this moment it is not advisable to think about new laws (from 1860 to 1910, 34 laws were proposed relating to land management of which 19 directly concerned forestry). Maybe the law of 1923 will have to be slightly amended. With this in mind, it may be helpful to look at the size classes of Italian forest properties. According to 1938 statistics the total forest area is 5,586,000 hectares, that in private ownership is 3,519,000 hectares, or 63 percent, communal and public institutions, 1,899,000 hectares, or 34 percent and state property 168,000 hectares, or 3 percent.

Limiting our discussion to the problem of conservation and intelligent management we have two major categories: public property (state, communes, etc.) 37 percent and private 63 percent. The state assists private owners by providing forestry police and protection. This is useful and necessary but not enough for adequate progress. I do not favor more state supervision of private forestry. In Italy there is already too much state tutelage of private forest property. In France, the government exercises control only over public forests and not over private forests. On the contrary, it is advisable to help private forest owners, to urge them to follow good technical practices (maybe with a cooperative system) and to make them understand with action and not with words how important their function is in forest production as a basic and irreplaceable element in forest-farm areas. We cannot continue draining forest resources without replacing them.

For public forests it is necessary to take into consideration in each case all of the local conditions, especially when considering the pasture and forest lands owned by communes and other public agencies. For instance, we cannot compare conditions in the Cadore and the Carnia with those in the south where, unfortunately, the communal and collectively owned mountain properties are generally in very bad condition.

It is most important to be sure that we have good, honest and continuous technical and administrative management. This can be

obtained in many ways, and if necessary, by direct supervision under the state government.

Everybody realizes that the forest property under state ownership at present is very small and should be increased. The Luzzatti law for enlarging state forests should be reinstated. The state forest service must again have its full financial and administrative autonomy and its income must be expended entirely for enlarging and improving state forest property. Forest administration must have more autonomy and less bureaucracy. Simple accounting is needed. The present system, if rigidly enforced, would be a great handicap to administration and cause serious financial difficulty. Government should always provide a forest reserve and at the same time furnish a good example of intelligent administration from both the economics and cultural standpoint. This happens seldom. If the state forest administration is not efficient, how can we advocate the principle of enlarging state ownership and for entrusting the communal properties to the same administration.

To increase timber yields we could convert coppice to high stands, but this can only be done on large state forests. Such a conversion defers income for long periods so that it is not financially practical for private owners. The conversion to coppice with standards, particularly in oak forests where acorn production is significant, is only possible in private ownership if large areas are involved, but in mountain lands with many small ownerships it is very difficult to effect such a change.

Reforestation has two main purposes: hydrologic and economic. In the public interest the government has to reforest for watershed purposes, but it does not always have to do only this work for it can often be correlated with the economic objective. Thus, if mountain people will organize to build dams, buildings, roads, etc., under technical direction, the state forest service will be greatly assisted and then can perform more easily its specific functions; namely, those of inspecting and supervising. Maybe it is too optimistic to hope that such an organization of mountain people would be a major factor in restoring their lands to productivity. But, without considering new types of organizations, the existing bodies could undertake such works and not wait for the government. The land improvement organizations (Consorzi di Bonifica) are qualified to correlate forest restoration with water control, agriculture and tree culture - provide complete integral land development from the plains to the hills to the mountains. These and other solutions should be reviewed and carried out. The main thing is to stop state centralization in this kind of work.

To attain our economic objective, we must hope for greater private initiative, especially under a cooperative system to reforest and to afforest. For this it is difficult to foresee and calculate the advantages of investing capital. Since the beginning of this century,

money value has greatly fluctuated. It is interesting to review the complicated calculations of 20 or 30 years ago concerning the economic advantages of reforesting the Carso with black pine, or the banks of the Po with poplar. Overlooking fluctuating money values we see that the real value of wood is increasing; thus, demonstrating the economic advantage of planting.

But what of the future? Perhaps the new system of international exchange and changes in the productive economy of the nations will bring about conditions we cannot foresee. Due to the decrease of world forest reserves, to the enormous requirements for reconstruction and to the difficulty of obtaining transport, it is very likely that lumber will be among the raw materials which will move more slowly to countries which do not have forest products.

Many technical men will be needed to carry out forest restoration, but decentralization of our state forestry administration should reduce the need somewhat. We should encourage the best use of our technicians, not only for policing and protection, but also for directing, assisting, coordinating and encouraging technical activities. On the other hand, foresters will find many other things which can and should be done by organizations, private owners and industries. Good laws, financial means and well-designed plans will be of little use without well-qualified men who enjoy the work with which they are entrusted. They must be professional yet practical in the woods and mountains where they will deal with strong and honest people who need guidance and advice.

The education of technical people is basic. It is most important to extend the education of forestry and agrarian-forestry technicians both inside and outside the state administration to qualified collaborators. Furthermore, the people who are not educated should be enlightened for it is essential to have the cooperation of all.

Up to now I have given only a partial outline of a program for developing and carrying out the main, technical principles which should guide our forestry progress. However, this outline may be useful as a basis for examining and discussing national policies. As stated previously, it is about ideas and proposals which have been made in view of present conditions and does not take into consideration basic changes in our economic and social structure. By studying the history of forestry many cood concepts may be drawn. The expanse of the forest area is a "sine qua non" condition for its preservation and orderly management. The first point to keep in mind is that cutting large landed estates of the south into small tracts and assigning them to the farmers has resulted in large-scale forest destruction. The second point is that in Italy very few forest farms are economically independent. They are indissolubly tied to the agricultural and pastoral economy.

Before finishing this paper I want to say that the forestry problem is too complicated and too extensive to be settled only by foresters and agricultural people working jointly. It is a national problem and all groups must contribute to its solution.

In recent years heavy cutting of our scant forest resources, including the trees in the fields, along the roads and in the parks and gardens makes it necessary to curtail cutting as soon as possible, and to have a period for renewing and reconstructing our wood supply. It will be very difficult to do this while such a great demand for charcoal continues and such an enormous quantity of lumber is required for reconstruction. Therefore, to save the remaining forests and avoid the most grave consequences of further destruction, it will be necessary to import coal, oil, cellulose, timber and pulp for making paper - all of these materials to conserve our forest economy. We do not know how large these imports should be, but to keep imports down, a complete program should be studied and carried out for reducing the national consumption of wood for fuel as well as for construction. Many plans have been made. Therefore, it is not my intention to discuss this topic. I only remark that in a country lacking every kind of fuel, as in Italy, the tremendous waste caused by primitive fuel systems should not be permitted.

Hydro-electric energy should be employed for domestic heating and cooking. There are many ways to reduce the consumption of construction timber and to use its qualities more rationally. Due to the miraculous progress made in the technical use of construction timber, we can look forward to using lower quality timber. It is used now only as fuel and comes mainly from coppice woods. This alone should be enough to justify the establishment of a forest products institute. Unlike nearly every other civilized country, Italy does not have such an institute.

The Italian forest problem is one of means and men, chiefly men. These men need a technical, scientific education which they cannot obtain from schooling alone. Lacking this, they can hardly lead others through life. The science of forestry, as every other science, springs from experience - the eternal source of all human progress.